Original Article

Factors associated with complete vaccination schedules against hepatitis B in primary health care

Fatores associados à completude vacinal contra hepatite B entre profissionais de saúde da atenção primária

Cecília Natielly da Silva Gomes[1]
Danielle Nedson Rodrigues de Macêdo[1]
Luany do Nascimento Feitosa[1]
Emanoelle Fernandes Silva[1]
Maria Laura de Lima Brito Magalhães[2]
Breno Dias de Oliveira Martins[1]
Rosilane de Lima Brito Magalhães[1]

[1]Universidade Federal do Piauí.
Teresina, PI, Brazil.
[2]Universidade Federal do Ceará.
Fortaleza, CE, Brazil.

Corresponding author:
Cecília Natielly da Silva Gomes
Rua Padre Áureo Oliveira, 1824 – Cristo Rei
CEP: 64015-470. Teresina, PI, Brazil.
E-mail: ceciliaunderline@gmail.com

Conflict of interest: the authors have declared that there is no conflict of interest.

ABSTRACT

Objective: to analyze factors associated with full hepatitis B vaccination in primary health care workers. **Methods:** cross-sectional research involving primary care health workers through the application of an instrument, verification of vaccination records, and blood collection to detect serological markers. **Results:** the prevalence of complete vaccination records was 108 (68.5%). White, brown, and Asian persons were significantly associated (p<0.05) with a reduction in the prevalence of full vaccination records; the same was true for having more than one employment. Having finished high school/technical education or having higher education/specializations were associated with complete records. **Conclusion:** full vaccination was satisfactory, showing a high prevalence. Social factors, such as ethnicity, educational level, and the number of employments influenced full vaccination. **Contributions to practice:** this study can guide practices and interventions in the field of health, in order to promote the health of primary care workers.
Descriptors: Hepatitis B; Primary Health Care; Seroconversion; Hepatitis B Vaccines.

RESUMO

Objetivo: analisar os fatores associados à completude vacinal contra a hepatite B entre profissionais de saúde da atenção primária. **Métodos:** pesquisa transversal analítica envolvendo trabalhadores de saúde da atenção primária com aplicação de instrumento, verificação do cartão de vacina e coleta de sangue para a detecção dos marcadores sorológicos. **Resultados:** a prevalência da completude vacinal foi 108 (68,5%). Estiveram associadas significativamente (p<0,05) a uma redução da prevalência de completude vacinal as cores de pele branca, parda e amarela, e ter mais de um vínculo empregatício. Ter ensino médio/técnico ou superior/especialização foram fatores que aumentaram a completude vacinal. **Conclusão:** a completude vacinal foi satisfatória, em decorrência da elevada prevalência. Fatores sociais, como a cor da pele e a escolaridade, assim como o número de vínculos empregatícios, exerceram influência na completude vacinal. **Contribuições para a prática:** o estudo pode orientar práticas e intervenções na área da saúde, visando a promoção da saúde dos trabalhadores da atenção primária.
Descritores: Hepatite B; Atenção Primária à Saúde; Soroconversão; Vacinas Contra Hepatite B.

Introduction

Hepatitis B virus (HBV) infections have a high impact on public health, considering how infectious and endemic the disease is. Despite preventive measures, detection, and treatment, hepatitis B is still one of the ten main causes of death in the world[1-2]. Estimates show that one in every three people was exposed to the virus, and most people infected are asymptomatic[3]. In Brazil, the prevalence varies, with higher rates in the North[4].

Hepatitis B vaccination is recognized as the main and most effective prevention measure, being applied in three doses, with intervals of zero, one, and six months, according to the recommendations of the National Immunization Program, which are applied to the entire country[5]. However, some people may not respond to the vaccine due to several conditions, including factors associated with chronic diseases, obesity, and smoking[6-8].

Health workers deal with an increased risk of HBV exposure due to the nature of their work, during which they may get in touch with contaminated biological materials. This is corroborated by the increased number of notifications of work accidents, which, in most cases, are related to percutaneous exposure[9]. In addition, intense work journeys can contribute to increase risk of infection due to fatigue and inadequate sleep[10].

Despite the availability of the vaccine and immunization campaigns, full vaccination in health workers is variable. Previous studies found prevalence's of 38.5%[11] e 79.1%[12]. Among factors that contribute to full vaccination schedules are: being female, working in direct patient care, having human and material resources available, a positive self-perception of health[11], a longer time working in the field, daily exposure to fluids, and performing invasive procedures[12].

It stands out that most workers deal with the health workers in hospital contexts. Research in this respect in the primary care is still scarce[11-14]. However, the few references found by this investigation indicate there is a good adherence to the three doses of the vaccine. This is confirmed by a study which found a prevalence of 56.9% of full vaccine records in primary care workers; however, about one third of these workers were not immunized, according with the hepatitis B surface antigen (anti-HBs) examination[15].

Furthermore, it must be noted that the routine of primary health care work help them recognize the risks[15], favoring adherence to vaccination. On the other hand, there is vaccine hesitancy related to information on the benefits of the vaccine, concerns about adverse effects, the mistaken perception of not being exposed to risk, and ignorance of one's own serological status[16], factors which, coupled with the lack of exams to check for seroconversion (antig-HBs), make it difficult to complete the vaccination schedule.

Considering the above, this study aimed to analyze factors associated with full hepatitis B vaccination in primary health care workers.

Methods

This is an analytical, cross-sectional study, reported according with recommendations from the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE). This research is part of a larger project named "Evaluation of responses to hepatitis B vaccination in primary care health professionals". The observational part of the study was carried out in two of the four regions (West and South) of Teresina, capital of the state of Piauí, a city which is divided for the purposes of providing primary health care.

Data collection was only carried out by the teams who worked the morning shifts, since blood collection only took place in this period, and samples were sent to the lab for analysis at 10 am.

Some health units were not included as they did not have a room for collection. This was only found by the researchers when they got to the location, which limited the number of workers involved in data collection. As a result, we could not determine precisely how many of them worked only in the morning shift.

It was necessary to resort to convenience sample, since the focus of the study was the zones South and West, and there was a limitation regarding the hour of collection. In total, 108 professionals agreed to participate in the study. Nurses, nursing assistants, nursing technicians, physicians, and oral health professionals were included. We excluded those who worked in units that did not carry out blood sample collections for exams. We did not consider non-inclusion criteria.

Data collection was carried out form October 2022 to June 2023 in the units themselves, during the work hours of the professionals, with the agreement of the coordinators. It should be noted that we waited for a proper moment to carry out the interview, in such a way that it would not interfere in the routine of the service and in the work activities of the participants.

A form created by the authors was applied, including variables related to participant characterization (professional class, sex, marital status, ethnicity, type of employment contract, incomme, and education), behavioral variables (HBV training, drinking, tattoos/piercings, accidents with biological/sharp materials), and data regarding serological markers, such as hepatitis B surface antigen (HBsAg)/acute or chronic infection; total antibodies against the hepatitis B virus core (anti-HBc)/antibody of the classes; immunoglobulin M (IgM) and immunoglobulin G (IgG); and anti-HBs/immunity, with a result >10 mUI/mL.

Full vaccination schedules were checked in the vaccination records of the professional. After applying the instrument, participants received guidance regarding the procedure of blood collection and were encouraged to attend the next day or during the week, according to their availability.

The serological markers were verified using a blood exam, which was collected in the Primary Care Unit itself by those responsible for the exam collection room. It is noteworthy that, in this municipality, blood tests, including HBV serologies, are analyzed by the diagnostic center Dr. Raul Bacellar, using the method known as chemiluminescence microparticle immunoassay for sample processing.

To facilitate communication, contact was maintained with the exam collection room via a phone number, through which researchers were informed when tests results were ready. At time of collection, each participant received a code that allowed them to access their exam online later or pick it up at the same place where the collection had been made.

Data were analyzed using the statistical software SPSS, version 21.0. The main outcome of this study was the presence of full vaccination schedules against HBV. Categorical variables were presented using absolute and relative frequencies. Numerical variables, on the other hand, were described using medians, first and third quartiles, interquartile range IQR), and minimum and maximum values. The median was adopted due to the non-normal distribution of the data, as ascertained by the Kolmogorov-Smirnov test.

The association between exposure and outcome variables were investigated using the chi-squared test or Fisher's exact. To verify factors associated with complete vaccine schedules, we used a robust Poisson regression. We included in the model all variables whose p-value was 0.20 or lower in a bivariate analysis. We used the stepwise backward method and the Omnibus test in the regression. Prevalence rations and their respective confidence intervals were estimated in 95%. A significance level of 5% ($p<0.05$) was adopted.

This project respected the ethical standards set by resolutions 466/2012 and 580/2018 by the National Council of Health, which regulate research with human beings. It was approved by the Research Ethics Committee of the *Universidade Federal do Piauí* under opinion 4,218,806/2020 and Certificate of Presentation for Ethical Appreciation 31484820.7.0000.5214.

Results

108 health workers participated in the study. The age median was 42.5 years (IQR=17), with a first

quartile of 33.25 and a third quartile of 51.75. The minimum was 24 years and the maximum, 74. Most participants were female (87%), with complete higher education or specialization (75.9%). The most common professional category was of nursing technicians (36.1%), and a little more than half participants had more than one employment (50.9%).

The prevalence of complete vaccination schedules (three doses) was 74 (68.5%). Among those vaccinated, 12 (11.1%) had received up to two doses and 22 (20.3%) did not know how many doses they had taken. Complete vaccination schedules for nurses (84.5%), dental surgeons (70.6%), and oral health auxiliaries or technicians (66.7%) was relatively high. Complete vaccination records were slightly less common for nursing technicians (64.1%) and physicians (61.1%). In bivariate analysis, Asian participants had

a higher prevalence of complete vaccination schedules than black participants. The other demographic variables showed no statistically significant differences considering the outcome being investigated (Table 1).

These remained in the robust Poisson model, explaining complete vaccination records, ethnicity, employment bonds, and educational level. White, brown, or Asian health workers had complete schedules less often than their black counterparts. Having more than one employment bond increased the frequency of the outcome being investigated by 27%. Professionals with complete high school/technical education and higher education/specialization were more likely to present complete vaccination records than MS or PhD professionals (Table 1).

In the multiple bivariate analysis, no behavioral variable presented a significant association (Table 2).

Table 1 – Association between demographic variables and complete vaccination schedules (n=108). Teresina, PI, Brazil, 2023

Variables	HBV vaccination schedule*		Bivariate analysis		Multiple analysis	
	Complete n (%)	Incomplete n (%)	p-value	Crude PR† (CI‡95%)	p-value§	adjusted RP (CI 95%)
Professional class						
Nurse	16(84.2)	3(15.8)	0.430‖	1.3 (0.84-1.9)	0.443	1.12 (0.82-1.53)
Nursing technician	25(64.1)	14(35.9)	0.860¶	1.0 (0.63-1.50)	0.542	0.93 (0.73-1.17)
Dental surgeon	12(70.6)	5(29.4)	1.000‖	1.1 (0.70-1.70)	0.669	0.96 (0.80-1.15)
Physician	11(61.1)	7(38.9)	0.741¶	0.9 (0.55-1.53)	0.522	1.10 (0.81-1.48)
Oral health assistant or technician	10(66.7)	5(33.3)	–	1**	–	1**
Sex						
Male	10(71.4)	4(28.6)	1.000‖	1.05 (0.73-1.50)	0.543	0.93 (0.75-1.16)
Female	64(68.1)	30(31.9)	–	1**	–	1**
Marital Status						
Has a partner	64(68.1)	30(31.9)	1.000‖	1.0 (0.67-1.34)	–	–
No partner	10(71.4)	4(28.6)	–	1**	–	1**
Color						
White	19(76.0)	6(24.0)	0.060‖	2.1 (1.00-4.71)	0.005	0.72 (0.58-0.91)
Brown	50(70.4)	21(29.6)	0.6‖	1.9 (0.90-4.30)	0.015	0.79 (0.65-0.95)
Asian	1(100.0)	–	<0.001‖	2.8 (1.3-6.0)	0.000	0.47 (0.38-0.58)
Black	4(36.4)	7(63.6)	–	1**	–	1**
More than one employment						
Yes	33(60.0)	22(40.0)	0.052¶	0.78 (0.60-1.01)	0.001	1.27 (1.10-1.46)
No	41(77.4)	12(22.6)	–	1**	–	1**
Income (minimum wages)						
>1 a ≤ 2	26(63.4)	15(36.6)	0.550¶	0.91 (0.70-1.23)	0.439	1.11 (0.84-1.46)
>3 a ≤ 4	14(77.8)	4(22.2)	0.500¶	1.1 (0.82-1.53)	0.683	0.95 (0.75-1.20)
> 4	34(69.4)	15(30.6)	–	1**	–	1**
Educational level						
High school/Technical education	14(58.3)	10(41.7)	0.734‖	0.58 (0.42-0.82)	0.000	1.58 (1.22-2.05)
Higher education/Specialization	58(70.7)	24(29.3)	1.000‖	0.70 (0.61-0.81)	0.001	1.41 (1.16-1.71)
MS/PhD	2(100.0)	–	–	1**	–	1**

*HBV: Hepatitis B virus; †PR: Prevalence ratio; ‡CI: Confidence interval; §Omnibus test; ‖Fisher's exact; ¶Pearson's chi-square; **1: Reference category

Table 2 – Association between behavioral variables and complete vaccination schedules (n=108). Teresina, PI, Brazil, 2023

Variable	HBV vaccination schedule*		p-value†	Crude PR‡ (CI§ 95%)	p-value¶	Adjusted PR (CI 95%)
	Complete n (%)	Incomplete n (%)				
HBV training						
Yes	29(76.3)	9(23.7)	0.199	1.19 (0.92-1.52)	0.254	0.92 (0.80-1.06)
No	45(64.3)	25(35.7)		1‖		1‖
Drinking						
Yes	29(70.7)	12(29.3)	0.698	1.05 (0.81-1.36)	0.688	0.97 (0.84-1.11)
No	45(67.2)	22(32.8)		1‖		1‖
Tattoo/Piercing						
Yes	18(64.3)	10(35.7)	0.575	0.92 (0.67-1.25)	0.770	1.02 (0.87-1.19)
No	56(70.0)	24(30.0)		1‖		1‖
Accident with biological or sharp material						
Yes	36(72.0)	14(28.0)	0.469	1.10 (0.85-1.42)	0.743	0.97 (0.85-1.11)
No	38(65.5)	20(34.5)		1‖		1‖

*HBV-Hepatitis B virus; †Pearson's chi-square; ‡PR: Prevalence ratio; §CI: Confidence interval; ¶ Omnibus test; ‖1: Reference category

76 of the participants went to the laboratory for blood collection. Regarding data associated with serological markers, 100% of the sample was negative for HBsAg, while 1.3% was positive for anti-HBc, and 78.9% was positive for anti-HBs. 40.7% of participants stated not having underwent anti-HBs exams after vaccination, and 20.4% did not know.

Discussion

This study investigated factors associated with full vaccination schedules against HBV in health workers. The results show that complete vaccination records, which were considered as such when the three recommended doses were indicated in the records, is considered to be high among primary care health workers, suggesting a good adherence to the vacicne. Furthermore, the immune response, for those who underwent the anti-HBs test, suggest that most of those where vaccinated developed immunity against HBV. However, almost half of participants did not undergo the anti-HBs test after vaccination, which can reflect a gap in the post-vaccination follow-up.

Although a significant percentage of professionals (75%) recognize that vaccination is efficient in preventing the disease[17], national and international data suggest that rates of complete vaccination records are below ideal[11,18]. In summary, adherence to vaccination schedules are still an important challenge in general. To ensure protection against these diseases, the three recommended doses must be administered.

Regarding seroconversion, less than 5% of health workers have checked their titration within the recommended period after taking the last dose of the vaccine[19], the same result found in this study. Nonetheless, in comparison with previous research, this investigation found a higher level of positive results[13]. Despite this advance, it is essential to develop strategies that encourage post-vaccination testing, since even after finishing the vaccination schedule, there may still be a ineffective response to the vaccination, increasing the risk of infection[5].

The analysis of the Poisson regression showed a significant relation between ethnicity and complete vaccination records. Data suggests that white, brown, or Asian individuals have a lower prevalence of

complete vaccination schedules. This finding is unexpected and contradictory, considering that, according with another research, white health workers represent the highest percentage of adherence to vaccination campaigns, when compared to other ethnicities[20]. This contrast suggests that there is a potential variation in behavior towards vaccines depending on one's ethnicity.

Ethnic disparities in the access and acceptance of vaccination have been widely documented, especially in minority communities and historically marginalized groups. Factors such as socioeconomic inequality, limited access to quality health services, and distrust of health institutions contribute to these differences[21].

Regarding brown and Asian persons, literature is scarce. However, there is evidence to suggest a greater prevalence of cases of hepatitis B in brown people, suggesting that incomplete vaccine schedules may make them more susceptible to infection[22]. On the other hand, literature indicates that black and brown persons are the ones who tend to have the lowest chances of receiving the three doses of the vaccine, considering different population groups[23-24]. This increases the prevalence of an incomplete vaccination schedule in the black population, which differs from the data found in this investigation.

These results emphasize the need for more inclusive vaccination policies, ones that consider racial disparities and promote equal access and distribution of vaccines. If relevant policies do not address these differences, they run the risk of perpetuating inequalities and limiting the access of marginalized communities to health. Therefore, it is essential for vaccination programs to recognize racial variables and to implement strategies that promote an equal and fair distribution of vaccines, especially in the context of health workers, who are vital for the wellbeing of the general public.

Another finding of this study is the higher prevalence of complete vaccine schedules in health workers with more than one employments and basic to intermediary educational levels. According to literature, a higher workload can also limit complete vaccination[7]. Professionals with more than one employment tend to find it more difficult to prioritize self-care, due to overloaded records[18]. Nonetheless, these factors contradict the findings of this study, since we found a higher prevalence of adherence to vaccination schedules even when there was more than one employment, which can be explained by a higher perception of risk due to the high workload and the resulting greater exposure[25].

In the context of educational levels, the high school/technical, or higher education/specialization workers had higher prevalences of complete records. Regarding those with high school/technical education, this can be explained by the fact that these workers work in direct assistance and are frequently involved in activities that can increase exposure to infectious diseases. This positive adherence indicates that these professionals perceive themselves as being under immediate risk, making them more likely to complete their vaccination schedules[11-12].

This prevalence was also high in higher education/specialized workers. This can be a significant factor, since higher education workers understand the vaccine better and, therefore, are more likely to take the three doses[20,26]. This trend has also been observed in five other developing countries[27]. The same results were found in Ghana, where most people with higher education had been vaccinated for HBV[28].

In this regard, we can infer that the educational level is an important factor in regard to people's perception of HBV risk, determining the completeness of their vaccination records. Workers in activity in direct assistance tend to understand better the risks associated with the lack of vaccination, which leads to a greater adherence to immunization. Education also has a crucial role in the perception of risk, contributing for a clearer understanding of the importance of vaccination as a preventive measure. This explains why there

is a higher prevalence of complete vaccination schedules in those who understand the topic better.

Study limitations

This study has some limitations, since it is a cross-sectional study, meaning it cannot establish cause and effect relationships between exposure variables and their results. It can also be affected by reverse causality among the variables included in the robust Poisson regression and the result researched. Furthermore, the use of a convenience sample to estimate associations may have introduced imprecision, since there was no probabilistic selection. Another factor that may have affected the precision of the results is the long observation period, which may have led to an overestimation of the prevalence of complete vaccination, due to the risk of prevalence bias. Eligibility criteria for the selection of participants may also have influenced the results, especially considering that data collection was restricted to the morning shift and to units that could collect for laboratory exams, limiting the number of participants and potentially leading to the underrepresentation of certain characteristics of the population.

Contributions to practice

The results of this study can be used to guide policies, intervention strategies, new research, and better monitoring in the field of vaccination of health workers in primary care, contributing to maintain and improve vaccine coverage. This analysis highlighted the importance of addressing factors beyond professional practice, such as ethnicity, and those related to workloads and educational levels, which can influence vaccination rates. It is essential to investigate how ethnicity can be related to a lower adherence to vaccination, and also to encourage professionals with lower educational levels of double work journeys to maintain consistent levels of vaccination. Furthermore, this research suggest that it is necessary to understand why professionals with a single employment

had a lower vaccination rate than those with multiple ones. The same is true for workers with higher levels of education, such as MS and PhD participants.

Conclusion

Complete vaccination records presented a relatively high prevalence, indicating a good level of adherence to the vaccination program, but also the need to improve, since there is still a significant portion of participants who did not take the three doses. Most participants presented seroconversion and none of them presented acute hepatitis B infections. Nonetheless, few undergo the exam after the last dose of the vaccine, highlighting the need for post-vaccination follow up, in order to confirm the efficacy of the vaccination.

Regarding the associated factors, the prevalence of white, brown, and Asian persons who finish their vaccination schedule was lower than that of black persons. On the other hand, having more than one employment and an education level from high school to specialization, increased the odds of showing a complete vaccination schedule. We recommend the implementation of specific strategies that can help increase adherence to the vaccination schedule, in addition to activities of continued education regarding hepatitis B.

Authors' contributions

Concept and design or analysis and interpretation of data: Gomes CNS, Macedo DNR, Feitosa LN, Silva EF, Magalhães MLLB, Martins BDO, Magalhães RLB. Writing of the manuscript or relevant critical review of the intellectual content: Macedo DNR, Feitosa LN, Silva EF, Martins BDO, Magalhães RLB. Final approval of the version to be published: Gomes CNS, Macedo DNR, Feitosa LN, Silva EF, Magalhães MLLB, Martins BDO, Magalhães RLB. Responsibility for all aspects of the text and for ensuring the accuracy and completeness of any part of the manuscript: Magalhães RLB.

References

1. Nikolopoulou GB, Tzoutzas I, Tsakris A, Maltezou HC. Hepatitis B in healthcare personnel: an update on the global landscape. Viruses. 2023;15(12):2454. doi: https://doi.org/10.3390/v15122454

2. Oliveira VMC, Gomes CNS, Rocha DM, Abreu WJCP, Galvão MTG, Magalhães RLB. Nurses' knowledge, attitudes and practices regarding hepatitis B: an integrative review. Texto Contexto Enferm. 2022;31:e20210187. doi: https://doi.org/10.1590/1980-265X-TCE-2021-0187

3. Mohanty P, Jena P, Patnaik L. Vaccination against hepatitis B: a scoping review. Asian Pac J Cancer Prev. 2020;21(12):3453-9. doi: https://doi.org/10.31557/APJCP.2020.21.12.3453

4. Alburqueque IC, Soeiro VMS, Lima RA, Ferreira ASP. Trends and spatial distribution of hepatitis B in pregnant women in Brazil. Rev Bras Saúde Mater Infant. 2024;24:e20230091. doi: https://doi.org/10.1590/1806-9304202400000091-en

5. Ministério da Saúde (BR). Manual dos Centros de Referência para Imunobiológicos Especiais [Internet]. 2023 [cited Feb 14, 2024]. Available from: https://www.gov.br/saude/pt-br/vacinacao/arquivos/manual-dos-centros-de-referencia-para-imunobiologicos-especiais_6a-edicao_2023.pdf

6. Obiri-Yeboah D, Awuku YA, Adjei G, Cudjoe O, Benjamin AH, Obboh E, et al. Post Hepatitis B vaccination sero-conversion among health care workers in the Cape Coast Metropolis of Ghana. PLoS One. 2019;14(6):e0219148. doi: https://doi.org/10.1371/journal.pone.0219148

7. Hussein NA, Ismail AM, Jama SS. Assessment of hepatitis B vaccination status and associated factors among healthcare workers in Bosaso, Puntland, Somalia 2020. Biomed Res Int. 2022;2022:9074294. doi: https://dx.doi.org/10.1155/2022/9074294

8. Garbin CAS, Vanzo KLT, Moimaz SAS, Garbin AJÍ, Chiba FY. Vaccination coverage and immunity against hepatitis B in public health dentists. Rev Soc Bras Med Trop. 2019;52:e20180534. doi: https://doi.org/10.1590/0037-8682-0534-2018

9. Quirino EMB, Dourado CARO, Andrade IKL, Lima MCL, Pinho CM, Silva MAS, et al. Exposure to biological materials: work accidents among health professionals in the state of Pernambuco. Rev Epidemiol Control Infect. 2020;10(4):1-12. doi: https://doi.org/10.17058/reci.v10i4.15296

10. Berhan Z, Malede A, Gizeyatu A, Sisay T, Lingerew M, Kloos H, et al. Prevalence and associated factors of needle stick and sharps injuries among healthcare workers in northwestern Ethiopia. PLoS One. 2021;16(9):e0252039. doi: https://doi.org/10.1371/journal.pone.0252039

11. Araújo TM, Souza FD, Pinho PD. Vacinação e fatores associados entre trabalhadores da saúde. Cad Saude Pública. 2019;35(4):e00169618. doi: https://doi.org/10.1590/0102-311x00169618

12. Ansa GA, Ofori KNA, Houphouet EE, Amoabeng AA, Sifa JS, Amenuveve CK, et al. Hepatitis B vaccine uptake among healthcare workers in a referral hospital, Accra. Pan Afr Med J. 2019;33:96. doi: https://doi.org/10.11604/pamj.2019.33.96.18042

13. Kisangau EN, Awour A, Juma B, Odhiambo D, Muasya T, Kiio SN, et al. Prevalence of hepatitis B virus infection and uptake of hepatitis B vaccine among healthcare workers, Makueni County, Kenya 2017. J Public Health (Oxf). 2019;41(4):765-71. doi: https://doi.org/10.1093/pubmed/fdy186

14. Ndunguru B, Wilfred D, Kapesa A, Kilonzo SD, Mirambo M, Hyera F, et al. Low uptake of hepatitis B vaccination among healthcare workers in primary health facilities in Mwanza region, North-Western Tanzania. Front Public Health. 2023;11:1152193. doi: https://doi.org/10.3389/fpubh.2023.1152193

15. Farias Junior YC, Souza FO, Heliotério MC, Araújo TM, Pinho PS. Hepatitis B vaccination and serology among health personnel in a municipality in the Recôncavo Baiano, Brazil, 2019. Rev Bras Med Trab. 2023;21(4):e2022975. https://doi.org/10.47626/1679-4435-2022-975

16. Pujol FH, Toyé RM, Loureiro CL, Jaspe RC, Chemin I. Hepatitis B eradication: vaccine as a key player. Am J Transl Res [Internet]. 2023 [cited Feb 14, 2024];15(8):4971-83. Available from: https://e-century.us/web/journal_toc.php?journal=ajtr&volume=15&number=8

17. Alshammari TM, Aljofan M, Subaie G, Hussain T. Knowledge, awareness, attitude, and practice of health-care professionals toward hepatitis B disease and vaccination in Saudi Arabia. Hum Vaccin Immunother. 2019;15(12):2816-23. doi: https://doi.org/10.1080/21645515.2019.1629255

18. Ngum AM, Laure SJ, Tchetnya X, Tambe TA, Ngwayu CN, Wirsiy FS, et al. Vaccination against Hepatitis B among health care workers in the Bamenda Health District: influence of knowledge and attitudes, Cameroon. Pan Afr Med J. 2021;40:216. doi: https://doi.org/10.11604/pamj.2021.40.216.16856

19. Hiva S, Negar K, Mohammad-Reza P, Gholam-Reza G, Mohsen A, Ali-Asghar NG, et al. High level of vaccination and protection against hepatitis B with low rate of HCV infection markers among hospital health care personnel in north of Iran: a cross-sectional study. BMC Public Health. 2020;20(1):920. doi: https://dx.doi.org/10.1186/s12889-020-09032-6

20. Momplaisir FM, Kuter BJ, Ghadimi F, Browne S, Nkwihoreze H, Feemster KA, et al. Racial/ethnic differences in COVID-19 vaccine hesitancy among health care workers in 2 large academic hospitals. JAMA Netw Open. 2021;4(8):e2121931. doi: http://doi.org/10.1001/jamanetworkopen.2021.21931

21. Souza ARSV, Melo RL, Araújo BRO. Raça, gênero e classe uma revisão integrativa sobre os impactos dos determinantes sociais da saúde na infecção por COVID-19. Cad Grad Ciênc Biol Saúde [Internet]. 2022 [cited Apr 26, 2024];7(2):99-99. Available from: https://periodicos.set.edu.br/fitsbiosaude/article/view/9934

22. Leão DV, Belém RJ, Almeida KV, Reis VLR, Reis HS, Santos FS. Perfil epidemiológico das hepatites infectocontagiosas no estado do Pará. Rev Eletr Acervo Saúde. 2021;13(4):e6790-e6790. doi: https://doi.org/10.25248/reas.e6790.2021

23. Carpenter C, Bernardo B, Adeyanju T, Washington C, Fisher JL, Young G, et al. The association between internet use to obtain health information and receiving three doses of the Hepatitis B vaccine in a multi-ethnic population in Ohio. Prev Med Rep. 2023;33:102203. doi: https://doi.org/10.1016/j.pmedr.2023.102203

24. Oliveira VMC, Galvão MTG, Nunes RV, Carvalho MSM, Gomes CNS, Magalhães RLB. Hepatitis B vaccine adherence among homeless people. Rev Rene. 2021;22:e60690. doi: https://doi.org/10.15253/2175-6783.20212260690

25. Senoo-Dogbey VE, Anto F, Quansah R, Danso-Appiah A. Completion of three-dose hepatitis B vaccination cycle and associated factors among health care workers in the greater Accra region of Ghana. PLoS One. 2024;19(4):e0298771. doi: https://doi.org/10.1371/journal.pone.0298771

26. Awoke N, Mulgeta H, Lolaso T, Tekalign T, Samuel S, Obsa MS, et al. Full-dose hepatitis B virus vaccination coverage and associated factors among health care workers in Ethiopia: a systematic review and meta-analysis. PLoS One. 2020;15(10):e0241226. doi: https://doi.org/10.1371/journal.pone.024122

27. Duodu PA, Darkwah E, Agbadi P, Duah HO, Nutor JJ. Prevalence and geo-clinicodemographic factors associated with hepatitis B vaccination among healthcare workers in five developing countries. BMC Infect Dis. 2022;22(1):599. doi: https://doi.org/10.1186/s12879-022-07556-3

28. Oni OI, Osho OP, Oluwole MT, Osho ES, Ogungbeje A, Raji HM. Assessing the level of knowledge, uptake of hepatitis B virus vaccine, and its determinants among health workers across various levels of health facilities in Ondo, South West, Nigeria. Egypt J Intern Med. 2022;34:80. doi: https://doi.org/10.1186/s43162-022-00167-z